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VENTURE CAPITAL EXITS IN EUROPE: JOINT ANALYSIS OF EXIT  
ROUTE AND TIMING

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## **Abstract**

This dissertation examines the dynamics of exit options for European venture capital firms. Using a sample of 6652 investment rounds for 5461 VC-backed firms, we analyse the venture capitalists' decision on the timing of the exit, focusing on the time to IPO, trade sale and liquidation. We model the time to exit using a competing risks model to study the impact on the exit decision of the characteristics of the entrepreneurial firm, VC firm and market condition. Our results reveal that IPO is the first exit choice for VCs in Europe and that successful VC-backed firms who could not go public sufficiently quickly have to rely on other exit routes like trade sales. Moreover, the results show that liquidation exit route is prolonged the most when the committed amount of capital is larger. Furthermore, we show that debt and stock market conditions have a strong influence on all exit routes. We also provide evidence on the impact of syndicate size, the experience of VC firm, amount committed to VC-backed firm and geographical location.

**Key-words:** Venture Capital, Exit, Timing.

**JEL-Codes:** G24, G11, G32.

## Sumário

Esta dissertação analisa a dinâmica das opções de saída nas empresas de capital de risco na Europa. Usando uma amostra de 6652 rondas de investimento de 5461 empresas de capital de risco, examinamos a decisão dos capitalistas de risco sobre o momento de saída, focando na Oferta Pública Inicial, na Venda Estratégica e na Liquidação. Através de um modelo de riscos concorrentes calculamos o momento ideal de saída, de modo a estudar o impacto da decisão nas características da empresa empreendedora, na empresa de capital de risco e na condição de mercado.

Os nossos resultados indicam que, a Oferta Pública Inicial é a preferida para empresas de capital de risco. No entanto algumas empresas bem-sucedidas e apoiadas por capital de risco não conseguem rapidamente tornar-se públicas, e têm que optar por outras opções como a Venda Estratégica. No caso da Liquidação, os resultados sugerem que é mais prolongada quando a quantidade comprometida de capital é maior. As condições da dívida e do mercado de ações têm uma forte influência em todas as rotas de saída. Com este trabalho fornecemos também evidências sobre o impacto do tamanho do sindicato, a experiência da empresa de capital de risco, o montante comprometido com a empresa e a localização geográfica apoiada pelo capital de risco.

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# 1. Introduction

Venture capital (VC) is an important source of funding for new companies that might not get financed otherwise. It is a type of private equity typically invested in an early stage, entrepreneurial, innovative businesses to help them grow. These investments have high potential and bear high risk (Sahlman, 1990). Venture capitalists (VCs) are highly specialized investors who add value to new ventures by monitoring and participating in the investee's strategic decision making (Gompers and Lerner, 1999). The value of the venture depends on the exit conditions that may influence important decisions about business and R&D strategies, and the overall development of the firm. (Schwienbacher, 2009)

The exit is the last stage of involvement (i.e., divestment) by the VC in the company which is as important as the entry decision itself. The analysis of viable exit routes is the critical part of the due diligence process that VCs need to traverse before deciding whether or not to invest (Cumming and MacIntosh, 2003b). VC investments are characterized by a limited time horizon and closed-end funds, thus the assessment of possible exit options is important for VCs before they invest in new firms. As the exit is the only way to realize the return on the investment and the exit strategy must be developed to get the highest possible return.

The exit strategy is related to the interaction between two main dimensions: exit type and timing. Both dimensions affect the value of the investment (Schwienbacher, 2009). The previous literature on VC exits has shown that VCs time their exits using stage financing split into several rounds (Gompers, 1995). In addition to stage finance, VCs use several contractual rights between entrepreneurs to ensure the best exit outcome (Cumming, 2008a; Kaplan and Strömberg, 2003). Also, the speed of exit is linked to stock market conditions, economic activity and the quality of the legal system (Black and Gilson, 1998; Cumming et al., 2006; Schwienbacher, 2008).

Despite the crucial importance of VC for start-up companies, there is a lack of empirical evidence on the overall impact on economic growth.<sup>1</sup> However, the success of the VC

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<sup>1</sup> The contribution of VC to economic development is explored in terms of internal and external factors. The noteworthy paper is by Kortum and Lerner (2001) whose results suggest that venture funding has a strong positive impact on innovation. Further, Bygrave and Timmons (1992), Lerner (2002), Alemany and Marti (2005) have found that VC has a profound impact on the economy. However, demonstrating a causal

industry is an important factor in ensuring sufficient economic growth (Gompers and Lerner, 2001). For instance, Skype, SoundCloud and Spotify are successful established VC-backed companies that received VC in their early stage of development.

Due to the importance of exits, the subject of VC exits has received increasing attention from academics. There are many articles that cover various aspects of VC exits, however, most of the literature on VC focuses on the IPO exit vehicle.<sup>2</sup> This is understandable due to the ease of access to data for public listings relative to other exit forms. In addition, it is explained by the fact that exits through IPO are more relevant in the U.S. and associated with higher returns (Gompers and Lerner, 2004).

In the particular case of Europe, IPOs are not common. In 2016, the most prominent exit routes were trade sales and secondary buyouts.<sup>3</sup> Therefore, the research on the VC exit decision has been even more neglected. This paper analyses the exit decision in the European VC market in order to gain a better understanding of issues related to VC exit routes in Europe and the timing of different exit routes. We focus on the professional asset management activity that invests funds raised from institutional investors, thus excluding other forms of investments (crowdfunding, business angels), and other forms of financial intermediation. For a sample of 6652 VC investments exited during 2007–2018, we study the time to exit through IPO, trade sale and liquidation. In order to understand dynamics during the life of the fund, we are going to base our model employed by Giot and Schwienbacher (2007), relying on survival analysis and competing risks models, which allow getting insight into the joint distribution of exit type and timing.

The rest of the work is structured as follows. In Section 2, a literature review of the VC exits is made. First, we introduce the academic literature on VC structure and properties in the European VC market. Second, we recap the types of exits used by VCs and the timing of the exit. Section 3 provides a theoretical discussion of our variables and develops the

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relationship between the presence of VC investment and innovation or job growth is a challenging empirical problem because of estimation issues.

<sup>2</sup> See, among other, Lin and Smith (1998), Neus and Walz (2005) about reputation; Gompers (1996) about grandstanding theory of VC firms; Fischer and Pollock (2004) and Dimov and Shepherd (2005) about social and human capital; also Poulsen and Stegemoller (2008), Barry et al. (1990), Lerner (1994b).

<sup>3</sup> According to EVCA, divestments as the amount at cost distributed of 26.8% trade sales, 24.5% secondary sales, 11.4% write-offs, 6.6% IPOs, 20.1% buybacks, and 10.7% by other means of the total amount divested in 2016.

hypothesis. Survival analysis and the methodology applied in our study are explained in Section 4. Subsequently, in Section 5 we explain how the sample is constructed and give detailed descriptive analysis. The estimation results are presented in Section 6. Finally, Section 7 concludes.

## **2. Literature review**

The purpose of this chapter is to review the relevant literature to provide a better understanding of our topic. In this context, we present the main concepts of venture capital and its most relevant aspects concerning exit routes and exit types.

### **2.1. Venture capital**

VC is a subset of private equity<sup>4</sup> and refers to a professionally managed pool of capital that is invested in equity-linked securities of the private venture at various stages in their development. (Sahlman, 1990) Private equity is a broader term that also encompasses later-stage investments as well as buyouts and turnaround investments. Therefore private equity and VC are different in terms of the stage development of the entrepreneurial firm in which they invest.

VC firms tend to specialize in different types of companies – by industry, stage, or geographic region; and can be organized in several ways. The organization of VC firm influences the nature of fundraising and investment behaviour, including VCs time horizon. (Sahlman, 1990; Wright et al., 2005)

The VC process starts with fundraising. Then, it proceeds to the investment phase which includes monitoring and value-adding activities by VCs to portfolio firms. The second part continues as the VC-backed firm exits and VCs start raising additional funds. (Gompers and Lerner, 2001) Cumming et al. (2006) state that VCs' investment decision depends on the potential of successful exit route. The exit process is of central interest because VC investments typically do not pay dividends; rather, returns are derived from capital gains upon exit.

#### **2.1.1. The structure of venture capital**

This section describes and analyses the structure of VC organizations, focusing on the relationship between investors and VCs and between VC firms and the portfolio companies in which they invest.

All private equity funds are organized as limited partnerships that are financial intermediaries between sources of funds (typically institutional investors) and

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<sup>4</sup> Private equity is equity capital provided to unlisted companies, which includes all stages of the industry: venture capital, growth capital, replacement capital, rescue/turnaround and buyouts. (EVCA 2016 Yearbook)

entrepreneurial firms. (Phalippou and Gottschalg, 2009) VC partnership contract represents an agreement between the outside investors who supply their funds and the entrepreneurial ventures in which they invest (Bygrave and Timmons, 1992). As VC investments carried out by fund typically last first 3-5 years, limited partnerships last usually for 10 years with an option to be extended to 13 years. Fund managers (general partners, GPs) are typically becoming members of the board of directors and designated to take responsibility for the daily operations and management of the fund. Institutional investors (limited partners, LPs) become limited partners (pension funds, banks, insurance companies, mutual funds and endowments who have rights as partners) by providing capital to private equity funds at fund inception. (Sahlman, 1990) (Metrick and Yasuda, 2010) Although the main reason to limit the duration of a fund is to provide the LPs with liquidity, it also forces VC firms to exit investments at the end of the fund's life (Guler, 2007).

VCs acting as GPs retain important economic and ownership rights that allow them to intervene in the company's operations when needed. (Gompers and Lerner, 1999; Sahlman, 1990) VC firms manage money from LPs and make a percentage of return based on the success of the fund's portfolio companies. VCs are typically active investors and invest through syndicates in which one or more take the lead role in working with the portfolio firm (Barry et al., 1990). Usually, the lead VCs is the oldest one (Lerner, 1994b). The value-added of classic VC investment lies in the guidance, contracts, know-how, and support of the backers. (Bygrave and Timmons, 1992)

The goal with investments in the portfolio is to have capital gains upon an exit event without unnecessary delay, as entrepreneurial firms are typically not able to pay interest on debt or dividends on equity. (Schwienbacher, 2009) When a divestment occurs, the GP distributes the proceeds to its LPs (minus fees). The timing of these cash flows is typically unknown ex-ante (Metrick and Yasuda, 2010). Partnership contracts differ across different types of VC funds, different types of investors, different entrepreneurial firms, and across countries and over time.<sup>5</sup> The deal structure for VC fund has many variants and the rationale is to give investors ample downside protection and a favourable position for additional investment if the company is doing well (Zider, 1998).

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<sup>5</sup> See, for example, Kaplan and Strömberg (2003); Bartlett (1999).

Therefore, VCs are highly specialized investors who add value to new ventures by monitoring and participating in venture firms' strategic decision making. However, VC investments are characterized by a limited time horizon, thus the VC(s) has to decide when to exit and how to exit. As stated before, the exit decision is extremely important for VCs, because it is the only way to realize their returns from the initial investment.

### **2.1.2. The European venture capital market**

Europe is one of the regions in the world in which VC is most developed (Bertoni et al., 2015). Despite the significant regulatory efforts made by European countries to improve their attractiveness to VC, Europe still has not closed the historical gap with the U.S., such as the level of shareholder protection, the effectiveness of corporate governance, bankruptcy law and labour market rigidities. (Bertoni and Croce, 2011; Cumming et al., 2017; Martin et al., 2002) In addition to regulation, VC is extremely sensitive to the development of capital markets (Black and Gilson, 1998). Higher volumes of IPOs and trade sales accelerate and improve exits for VC investors (Giot and Schwienbacher, 2007). However, capital markets in continental Europe are historically bank based rather than market-based, and this factor has reportedly hindered the development of liquid capital markets.

The state of the capital market shows the professionalism of the financial state of the country, for deal flow and exit opportunities (Groh et al., 2010). There was a scant development of the European VC market in 1998 that resulted in a series of policy initiatives at the EU level, which were aimed to stimulate the supply and demand side of the VC market (e.g., tax incentives, aim to increase stock market openness and labour market flexibility). These changes ultimately led to a higher presence of governmental VC funds than in the U.S. (Cumming et al., 2017) According to Groh et al. (2010), the most attractive country for institutional investments into VC in Europe is the United Kingdom, followed by Ireland, Denmark, Sweden, Norway, and Germany. The United Kingdom composites its attractiveness<sup>6</sup> due to its investor protection and corporate governance rules, as well as its large and liquid capital market.

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<sup>6</sup> The composite index to measure the attractiveness has six key drivers: economic activity, depth of capital market, taxation, investor protection and corporate governance, human and social environment, and entrepreneurial culture.

Porta et al. (1998) findings support that the differences in the nature and effectiveness of financial systems between countries come from the differences in the legal protections of investors and law enforcement. They (1998) distinguished four legal systems: English, French, German, and Scandinavian<sup>7</sup>, comparing legal rules across 49 countries around the world. First, their results show that English-law (i.e. common law system) countries generally have the strongest and French-civil-law countries the weakest legal protections of investors, with German- and Scandinavian-civil-law countries being in the middle. Second, law enforcement has the best quality in German-civil-law and Scandinavian countries, followed by common-law and French-civil law countries. Additionally, La Porta et al. (1997) argue that the legal environment affects the size and breadth of capital markets, which apply to both equity and debt markets.

Regarding VCs activity, European VCs use similarly sophisticated monitoring devices as in the case in the U.S., although there are also important differences. Namely, the duration of exit stage is longer in Europe than in the U.S. Moreover, they replace less often former management and syndicate less often their deals. Strikingly, European VCs use convertible securities three times less compared to the U.S.<sup>8</sup> It is also found that European VCs are not very active as their U.S. counterparts and monitor less. All those differences mentioned above are linked to less liquid market conditions in Europe as it is difficult to find skilled human resources for new ventures and for the exit opportunities. Overall, the differences between European and the U.S. VC firms are greater for well-established (older) ones than for younger ones. (Schwienbacher, 2005)

## **2.2. Exit decisions**

Exit patterns vary depending on market conditions in the exit year, the characteristics of the fund, the characteristics of the portfolio company, and the characteristics of the transaction. An exit can be initiated by one of the three different types of events: the exhaustion of a VC's skill set, internal or external shocks, and new information about the location of the value added and/or maintenance cost curves (Cumming and MacIntosh, 2003b).

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<sup>7</sup> European countries that were included in the study were Ireland and the United Kingdom for English-origin law; Belgium, France, Greece, Italy, Netherlands, Portugal and Spain for French-origin; Austria and Germany for German-origin; Denmark, Finland and Sweden for Scandinavian-origin.

<sup>8</sup> We do not include this factor in our analysis because nearly all investments were financed in cash.

### 2.2.1. Type of exit route

In general, five main exit routes are considered for VC investments: IPO, trade sale, buyback, secondary sale, and liquidation. (Cumming and MacIntosh, 2003a; Cumming and MacIntosh, 2003b; MacIntosh and Cumming, 1997; Schwienbacher, 2009) During an IPO, a significant portion of the firm is sold into the public market so that the VCs can also sell their shares to the public. In a trade sale, the entire firm is sold to an existing firm, possibly a strategic acquirer. A management buy-out (i.e. buyback) is the case when VCs' shares are repurchased by the entrepreneur, while in secondary sale shares are sold to another institutional investor. In case of liquidation, the company files for bankruptcy and VCs abandon their investment. (Cumming and MacIntosh, 2001; MacIntosh and Cumming, 1997; Schwienbacher, 2009)

These exit routes vary widely in terms of the potential return they offer, the prestige involved in the exit, and the strain on both the entrepreneur and the VC. VCs typically earn the highest rates of return exiting through an IPO (Gompers and Lerner, 2004) or sell the portfolio firm at a high price.

Cumming and MacIntosh (2003a) additionally distinguished full and partial VC exits for all five exit types. A full exit occurs when VCs dispose all of their interest in the investee firm, while a partial exit indicates that VC retains at least part of his interest. Overall, the greater the degree of information asymmetry between the selling VC and the buyer(s), the greater the likelihood of partial exit and suggested that partial exits constitute as a signal of an investee firm's quality.

Active stock markets allow VCs to exit more easily through an IPO while leaving the entrepreneur in control of the firm (Black and Gilson, 1998). The main advantages for companies to go public are access to new finance (liquidity in equity market), enhanced company image and publicity; motivating management and employees through a share participation schemes; and the possibility for cashing in. (Röell, 1995)

Although a trade sale is the more universal exit strategy as it is available for more firms and not only to the most successful ones (Cumming and MacIntosh, 2001; Lerner, 1994b), IPOs are the most preferred strategies for VCs (Gompers, 1995).

One of the many driving principle for the quality of entrepreneurial firm relates to information asymmetries. In order to maximize the capital gain upon exit, a VC will choose

the exit route for which the new owners are best able to resolve information asymmetry. When informational asymmetries are lowest, the new owners are willing to pay more for the company. (Barry et al., 1990; Cumming and Fleming, 2002)

### **2.2.2. Timing of exit**

As already mentioned, VCs aim at optimal timing their exit timing, since their exit options are highly cyclical. The existing academic literature on VC exits has shown that VCs time their exits using stage financing split into several rounds (Gompers, 1995). In each round, the entrepreneur is given just enough financial resources to achieve the next intermediate development phase. This provides an option to exit at each financing round; VCs can abandon the project if future prospects are bad, fully finance the next round, or reduce involvement through syndication. This is essential because entrepreneurs are unlikely to stop their own projects as long as others provide capital. (Schwienbacher, 2009)

A theory formulated by Cumming and Johan (2010) suggest that VC investment duration is based on the idea that VCs exit when the expected marginal cost of maintaining the investment is greater than the expected marginal benefit. Their results confirmed the greater the value-adding by VCs, the longer the investment duration.<sup>9</sup> Cumming and MacIntosh (2001) confirmed that investment duration is affected by following variables – stage of a firm at first investment, capital available to the VC industry, whether the exit was preplanned and whether the exit was made in response to an unsolicited offer.<sup>10</sup>

When examining the VC exit process it is necessary to review the existing research on what determines the choice of exit route and how they influence the time to exit. In this study, we investigate the exits of European VC firms from their investee companies. The usual exit routes are IPO, trade sale and liquidation.

Our work considers three sets of factors, which are likely to interact, that could influence the timing of exit and the choice of the exit route. First, factors related to the entrepreneurial firm. Secondly, the VC fund structure – such as the holding period of the investment, how close the fund is to maturity, and the experience or specialization. Lastly,

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<sup>9</sup> Venture capital investment duration was related to entrepreneurial firm characteristics, investor characteristics, deal characteristics, institutional and market conditions.

<sup>10</sup> Their empirical results shows the greater the amount of VC fundraising, the shorter the duration of investment. Also, when exit is pre-planned, the duration of investment is shorter. In the shorter term, the limited supply of managerial talent operates as a constraint on the ability to launch new funds.

we want to examine whether the capital markets recognize variations in the quality of VCs whose companies are going public, and how the availability of debt affects the decision to exit through a trade sale.

### **3. Hypothesis development – exit decisions and type of exits for venture capital-backed firms**

In this section, we develop our research framework and present our hypothesis for the connection between VC exit decisions and type of exits. We only focus on the most important exit routes in our theoretical discussion, namely IPO, trade sale and liquidation.

#### **3.1. Geographical location of the entrepreneurial firm**

The exit choice is also influenced by the geographical location of the entrepreneurial firm. Several studies have concluded that exit choice depends on the institutional and legal factors of the specific country and market conditions. (Espenlaub et al., 2009; Schwienbacher, 2005; Shepherd and Zacharakis, 2001) Investors tend to allocate their capital to economic centres that have a well-developed cluster of entrepreneurial activities that support transactions and promote the capital flow. Also, there must be demand for the committed capital. (Groh et al., 2010)

Most of the research regarding VC exits in connection with the geographical location of VC is done for the U.S. market and comparisons between the U.S., Europe and Canada.<sup>11</sup> There is a lack of studies that solely focus on European countries inherent to VC exit dynamics.

In an analysis of European contracts and exits, there is a strong connection between the use of strong VC control rights and the probability of trade sale exits. Cumming (2008b) results indicate that strong VC control rights are associated with a higher probability of trade sales and a lower probability of IPOs and liquidations. Investors take less control and veto rights in countries of German legal origin, relative to Socialist, Scandinavian, and French legal origin (Cumming and Johan, 2008b). Therefore, it should be expected that firms in countries with strong VC control rights have a higher likelihood of a trade sale.

There are also cultural differences in entrepreneurship between countries but those patterns are hard to evaluate. Overall, we expect a positive effect for entrepreneurial firms

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<sup>11</sup> For example, Chen et al. (2010) study the geographic concentration by both VC firms and VC-backed firms in San Francisco, Boston and New York, while Giot and Schwienbacher (2007), Shepherd and Zacharakis (2001) analyse VC exit market by U.S. regions. Cumming and MacIntosh (2001); (2003a; 2003b), MacIntosh and Cumming (1997), and Cumming and Johan (2010) based their research on VC exits comparing U.S. and Canada.

located in countries with a more active stock market. Further, we want to test if there are any differences in the likelihood of faster exits between regions.

### **3.2. Regional proximity**

The research about the impact of proximity is mostly done about the pre-investment activities (opportunity identification and assessment) and the post-investment roles (monitoring and value-adding activities) wherein both cases local investing is favoured. Many economics and practitioner literature on VC often observe information asymmetries and agency problems between VCs and entrepreneurs, which makes an assessment of an opportunity more difficult. To identify good investment opportunities, VCs with deep contact networks in a geographic area can better assess the veracity of the information they receive. (Sorenson and Stuart, 2001) Naturally, the proximity of the board members of the VC to their entrepreneurial firm is less costly than more distant businesses (Lerner, 1995). European VCs that syndicate over cross-border have still a smaller social distance from these markets and therefore able to obtain better information from them (Jääskeläinen and Maula, 2014).

Not to discard, cross-border syndication can provide more complementary skills and capabilities from a VC firm abroad than domestic syndicates (Espanlaub et al., 2014). It has also been found that deal characteristics are influenced by macroeconomic factors. Countries with higher market capitalization receive more VC from abroad than countries with low capitalization (Aizenman and Kendall, 2008).

Nevertheless, VCs invest in firms that are geographically proximate because it enables them more conveniently to monitor and assist the entrepreneurial firm, as well as facilitate value-adding activities. Therefore, geographic proximity should help VCs make better decisions as it increases the chance of success. (Johan and Cumming, 2006) This is also supported by Dai et al. (2012) and Hochberg et al. (2007) who also found that proximity of the VC firm has a positive impact of the entrepreneurial firm for the exit performance. Overall, regional proximity favours better networking between parties and therefore should speed up exits. Giot and Schwiendbacher (2007) found that proximity makes trade sales more likely, although it did not impact the likelihood of an IPO and liquidation.

### **3.3. Syndicate size**

Syndication arises when VCs jointly invest in projects. The rationale behind the syndication of VC deals has been widely researched and suggested to influence VCs exit decisions. Syndication will provide a larger network, increasing the possibility of finding potential buyers, and hence speed up the exit process. Additionally, syndication may take place as a form of risk diversification and has reputation effects through syndication with more experienced VCs. Bigger syndicate can also improve the screening process through at least a second opinion, information and capital. (Gompers and Lerner, 2004; Lerner, 1994a)

Studies examining the size of the syndicate (Brander et al., 2002; Giot and Schwienbacher, 2007; Guler, 2007; Hege et al., 2009) have found them to be generally positively associated with the time to and the probability of a successful exit. Larger syndicate helps to add value as due to the bigger pool of contacts it is easier to find strategic buyers (Schwienbacher, 2005). In line with the reasoning, we expect the duration of the investment decrease with syndication size for all types of exit. In addition, we expect that a larger syndicate increases the likelihood of exiting through an IPO or a trade sale.

### **3.4. Venture capital firm experience**

One would expect the more experienced VC firm is, the more likely it is able to add value to the venture as it develops. Therefore, the higher is the probability of successful exits. We proxy experience by the age of the VC firm. Although there is no clear indication of the beginning of the VC industry, if the VC firm was founded before 1975, we use 1975 as the founding year, as little activity existed in the VC market before that time.<sup>12</sup> See Rind (1981) and Gompers and Lerner (2001) about the history of VC.

VC experience is closely related to reputation. Firms backed by more reputable VCs are more likely to exit successfully, namely through IPO (Nahata, 2008). While more experienced VC firms are concerned with not losing their reputation, younger VCs are trying to build one. This is supported by Gompers (1996), Neus and Walz (2005)<sup>13</sup>, and Lin

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<sup>12</sup> Institutional VC is originated in the U.S. The frequently indicated landmarks of the beginning of venture capitalism are the VC fund ARD established in 1946 and the foundation of small investment companies by the U.S. Small Business Administration in 1958. After a VC boom in the 1960s and the collapse during 1970s, the VC industry really started to grow rapidly in 1980s. (Bygrave and Timmons, 1992; Gompers, 1994)

<sup>13</sup> Found that young VC firms may use underpricing as a way to establish a reputation.

and Smith (1998) who investigated the exit decision of VCs during an IPO and found that young VC firms take companies public earlier than older VC firms in order to establish a reputation and successfully raise capital for new funds. However, old reputable VC firms do not need to signal because investors have seen their past performance and trust their capacity. Further, Barry et al. (1990) were the first ones to found that IPOs with higher quality VCs are less underpriced. Hence, the “success” of a fast exit via IPO is disputable as young VC firms are more underpriced at their IPO. Lerner (1994a) pointed out that reputation affects the risk aversion of VC firm. As the VC firm gains reputation through time, it is willing to accept investments with lower returns as long as the risk is lower. This suggests that more experienced syndicated deals are more likely to exit through a trade sale, while IPOs are more prone for younger VC firms to signal their reputation. The outcome for liquidations is less clear as there is a controversy between value-adding activity and abandonment of bad investments by VCs.

### **3.5. The amount of investment**

There are not enough studies to assess the relationship between the amount involved in the investment rounds and exit strategies. Cumming and Johan (2008a) found evidence for Canadian VC firms that the average deal size for the first round investments are larger for IPOs, as there are minimum capital requirements for listing and trade sales. The data also indicates that firms who are liquidated have more likely smaller investments, besides riskier investments result in worse outcomes. Gompers and Lerner (2004) results support the view – firms that go public have received significantly more total funding.

There is also a reason to believe that more capital invested into entrepreneurial firm should provide them more resources, hence facilitating the success and decreasing the time needed to complete their projects. On the other hand, a smaller amount of investment should give more time for monitoring and screening, as VCs stage their investments, or pursue unsuccessful projects until they are abandoned which both increase the time to exit. Therefore, there is a rationale to support that larger investment should decrease the time until a favourable exit. The previous study by Giot and Schwiendbacher (2007) found that invested amount of money has overall a positive effect to accelerate the exit. We expect this factor to behave in a similar manner in this study.

### 3.6. Market conditions

We want to examine whether the European capital market recognizes variations in the quality of VCs whose companies are going public. Market timing is a widely researched factor to influence the choice between an IPO and a trade sale. The level of development of local financial markets is important to attract and maximize the benefits of investments (Alfaro et al., 2004). Black and Gilson (1998) claim that the ability and realized returns exiting through an IPO are critical to the existence of vital VC market, and these factors are more important than the willingness to take risks.

There is time variation in adverse selection costs that creates window of opportunities. The current cost of debt and relative “hotness” of the IPO market are positively related to the probability of an IPO. (Black and Gilson, 1998; Brau et al., 2003; Lerner, 1994b) Cumming et al. (2005) also provide evidence that VCs adjust their investment decisions according to liquidity conditions on IPO exit markets – when exit markets are liquid, VCs speed up exit decision by investing more in a later-stage project. In line with the reasoning, during a hot (liquid) issue market when equity valuations are high VC-backed firms are likely to exit faster through an IPO. Market conditions may also affect liquidations in the same way, since VCs could decide faster to redirect their effort into new projects (Fulghieri and Sevilir, 2009).

However, if funds are able to arbitrage debt markets against equity markets when debt is more accessible, we would expect a higher probability for trade sales. The Fed tightening index is used as the proxy for the availability of capital in the credit market. The latter variable is motivated by Jenkinson and Sousa (2015) work which analyses the private equity exit decision for leveraged buyouts.

Another important variable in VC research is the stage of development as VCs time their exits splitting investment into several rounds, which helps to solve potential agency costs. The evidence shows that staging of investment allows VCs to monitor the progress of an entrepreneurial firm while maintaining the option to abandon it (Gompers, 1995)<sup>14</sup>. Normally, the higher the degree of information asymmetry (i.e. early stage investment), the longer the investment duration (Cumming and MacIntosh, 2001). The current work does

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<sup>14</sup> The paper by Gompers (1995) shows that firms who receive a significantly higher amount of investment and a greater amount of rounds are more likely to exit via an IPO rather than a trade sale or liquidation.

not test this issue due to data limitation. As seen in the preceding paragraphs, the choice of exit route and timing are influenced by a multitude of variables. The following section describes the method used to estimate those variables characterising entrepreneurial and VC firm, and capital market condition.

## 4. Methodology

Our statistical analysis of modelling VC exit behaviour relies on survival analysis and competing risk models. Standard survival data allows to measure the time elapsed between the origin date at which investment was made and the occurrence of VC exit of the investment date. Unlike ordinary regression models (OLS), survival analysis incorporates information from both censored and uncensored observations. Censoring occurs when there is incomplete observation. Naturally, venture capital firms are unlikely to exit all investments during the study time period (2007–2017) and it would be unsound to exclude yet not exited firms, which also provide important information. Static models can only consider one set of explanatory variables for each firm. Researchers who apply static models to VC exit have to select at what time to observe each firm's characteristics. They ignore data on firms that have not exited yet, which creates an unnecessary selection bias. However, survival analysis incorporates time-varying covariates which results in more precise parameter estimates. The final reason to prefer survival analysis is its ability to control each firm's period at risk (distribution). For example, VCs invest with a view to exit their investments; hence the time to exit from an investment should be constantly decreasing.

Competing risks data arises naturally in medical research when subjects under study are at risk of more than one mutually exclusive event such as death from different causes.<sup>15</sup> Competing risks concern the situation where more than one cause of event is possible, where only the first of the event is observed. (Putter et al., 2007) These models are the best suit for our analysis since it takes into account many possible type of exits. The purpose of the following section is to summarize key concepts of survival analysis. Then we will discuss how the competing risks model is implemented.

### 4.1. Survival analysis

Before explaining the competing risks model, it is important to explain some concepts in survival analysis. We are interested in the behaviour of the time to exit. Let  $T$  be the time until the exit.<sup>16</sup> There are four functions that characterize the distribution of  $T$  – the

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<sup>15</sup> The competing risk theory originates from the 18th century when Bernoulli studied the effect of elimination smallpox to a population mortality rates at different ages (Klein and Moeschberger, 2006).

<sup>16</sup> In this example,  $T$  is a nonnegative random variable from a homogeneous population.

survival function, the hazard rate (function), the probability density function and the mean residual life at time  $t$ . If we know any one of these four functions, then the other three can be uniquely determined (Klein and Moeschberger, 2006).

$T$  is strictly positive and its distribution is defined by the density function  $f(t)$  or the cumulative distribution function  $F(t)$  with

$$F(t) = \Pr(T \leq t) = \int_0^t f(s) ds \quad (1)$$

The survival function gives the probability of a firm surviving beyond time  $t$ , i.e. experiencing the exit after time  $x$ . That is

$$S(t) = \Pr(T > t) = 1 - F(t) \quad (2)$$

Also, the survival function is the integral of the probability density function,  $f(t)$ , that is  $S(t) = \Pr(T > t) = \int_t^\infty f(t) dt$ . Thus,

$$f(t) = -\frac{dS(t)}{dt} \quad (3)$$

This function gives the probability of an exit occurring at exactly time  $t$  out of all possible values of  $t$ .

The hazard function gives the conditional instantaneous probability of exit given that the firm at risk has not been exited at that given time (hazard rate)

$$h(t) = \lim_{\Delta t \rightarrow 0} \left( \frac{\Pr(t \leq T < t + \Delta t | T \geq t)}{\Delta t} \right) = \frac{f(t)}{S(t)} = -\frac{S'(t)}{S(t)} \quad (4)$$

Survival function and the hazard rate are linked between each other – when the survivor function decreases more (less) sharply in an interval, the higher (lower) is the hazard rate. The hazard rate varies as the underlying observations are changing. For instance, every firm has a hazard for each type of exit and as time goes by if the firm is successful, its hazards for IPO and trade sale increase while its hazard for liquidation decreases. Inversely, if the firm performs poorly, it is assumed that its hazards for IPO and trade sale would start to decline, while its hazard rate for liquidation increases.

For firms at time  $t$ , the mean residual life measures their expected remaining lifetime. It is defined as  $mrl(t) = E(T - t | T > t)$ .

## 4.2. The case of competing risks model for venture capital exits

Competing risks models are survival-data models in which the failures are generated by more than one underlying process. For instance, VCs can exit their investments through five exit routes as discussed in Section 2. In our study, IPO exit competes with trade sale and liquidation, where all exit routes are mutually exclusive.

We use accelerated failure-time (AFT)<sup>17</sup> model which adjusts survivor functions for the effects of covariates. It also encompasses a wider range of survival time distributions (Collett, 2015). In the AFT model, the natural logarithm of the survival time,  $\ln t$ , is expressed as a linear function of the covariates

$$\ln T_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \dots + \beta_k x_{ik} + z_j \quad (5)$$

where  $T_i$  is time to exit of a firm  $i$ ,  $x_{i1}, x_{i2}, \dots, x_{ik}$  are measures of  $k$  covariates of the firm  $i$ , and  $\beta$  are regression coefficients, and  $z_j$  is the error with density  $f()$ . The distributional form of the error term, which is influenced by the hazard function, determines the regression model.

For competing risks analysis, the influence of covariate can be evaluated in relation to cause-specific hazard or on the cumulative incidence functions. Additionally, the alternative option is subhazard introduced by Fine and Gray (1999). We are modelling the effect of covariates on cause-specific hazards for each type of exit. The cause-specific hazard helps to form all relevant information that can be observed from the data and give a more detailed picture by allowing to look at time trends (Gichangi and Vach, 2005).

As emphasized previously in standard survival analysis, hazard rates are important factors for the analysis of competing risks data, as they can be estimated in the presence of censored observations. The cause-specific hazard rate for exit type  $j$  is the natural adaption of the common hazard rate shown in equation (4), providing a firm's probability for exiting from an exit of type  $j$  in an infinitesimally small time interval  $t$  to  $t + \Delta t$  given it did not exit from any exit up to time  $t$

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<sup>17</sup> AFT model uses maximum likelihood method.

$$h_i(t) = \lim_{\Delta t \rightarrow 0} \frac{\Pr(t \leq T_i < t + \Delta t, J = j | T_i \geq t)}{\Delta t} \quad (6)$$

where,  $j = 1$  means that a firm exited through an IPO,  $j = 2$  through a trade sale and  $j = 3$  through a liquidation. Considering mutually exclusive exits, the overall hazard rate of exit is the sum of all the cause-specific hazard, where  $h_j(t, X)$  is the hazard function for exit type  $j$

$$h(t, X) = \sum_{j=1}^J h_j(t, X) \quad (7)$$

In this analysis, the generalized gamma density distribution is used as it is a highly flexible hazard function (non-monotonic) that allows for many possible shapes. The density function depends on three parameters,  $\kappa$ ,  $\sigma$  and  $\mu$  and is defined by

$$f(t, z, \sigma) = \begin{cases} \frac{\gamma^\gamma}{\sigma t \sqrt{\gamma} \Gamma(\gamma)} e^{(z\sqrt{\gamma} - u)}, & \text{if } \kappa \neq 0 \\ \frac{1}{\sigma t \sqrt{2\pi}} e^{(-\frac{z^2}{2})}, & \text{if } \kappa = 0 \end{cases} \quad (8)$$

where  $\gamma = |\kappa|^{-2}$ ,  $z = \frac{\text{sign}(\kappa)(\ln(t) - \mu)}{\sigma}$  and  $u = \gamma e^{(|\kappa|z)}$ . The explanatory variables affect the density function through  $\mu_i = X_i \beta$ , where  $i$  is the observations' index. The  $\kappa$  and  $\sigma$  are the shape parameters that affect the hazard function and encompass the flexibility to allow many density functions. It can be viewed as a generalization of the exponential if  $\kappa = \sigma = 1$ ; Weibull if  $\kappa = 1$ ; and the lognormal (standard Gamma) distribution if  $\kappa = 0$ . (Cleves et al., 2008) The exponential model is the simplest type of parametric model as it assumes that the baseline hazard is constant within each time period. The Weibull model hazard rate is either monotone increasing, decreasing, or constant. The log-logistic distribution has a hazard rate which is hump-shaped, i.e. it increases initially and, then, decreases. Therefore, it justifies the use of generalized gamma distribution as it gives considerable flexibility to capture properties of a distribution that may not be possible when using only one special case.

Finally, we estimate three mutually exclusive exit possibilities, where all variables that we are going to discuss in the next section are included. Our regression model is following

$$\begin{aligned}
\ln(T_{ij}) = & \beta_0 + \beta_{1,j}AMOUNT_i + \beta_{2,j}SYNDSIZE_i + \beta_{3,j}AGEOLDESTVC_i \\
& + \beta_{4,j}SAMECOUNTRYVC_i + \beta_{5,j}Fed\ tightening\ index_i \\
& + \beta_{6,j}Euronext\ return_i + \sum_{k=1}^7 \delta_{k,j}Industry_{k,i} \\
& + \sum_{k=1}^4 \delta_{k,j}Region_{k,i} + \sigma u_i
\end{aligned} \tag{9}$$

where  $I$  refers to the entrepreneurial firm and  $j$  is the exit type. The variable  $Industry_k$  is a dummy variable for industry  $k$  and the variable  $Region_k$  for region  $k$ .

AFT regression coefficient relates proportionate changes in survival time to a unit change in a given regressor, with all other characteristics held fixed (Jenkins, 2005). The regression coefficient  $\beta$  has a similar interpretation to linear regression. A significantly negative (positive) value for any  $\beta$  parameter implies that an increase (decrease) in the corresponding variable significantly accelerates (prolongs) the exit. For dummy variables, taking the exponential of the coefficients (i.e.,  $e^{\beta_{1,TS}}$ ) gives the time ratio. These time ratios can be easily compared with each other, *ceteris paribus*. The relative time ratio indicates how fast/slowly the change of category impacts the (conditional) exit probability. The following section describes the data collection process and the creation of variables to test our hypothesis.

## 5. Data construction and sample characteristics

One of the main issues concerning VC research is the availability of data. Moreover, because of the relative lack of disclosure of information and asymmetric information surrounding VC (Kaplan and Lerner, 2016), it is difficult to clarify conclusively the level of investments and exit dynamics. The latter of the problem is minimized in our study, as all the observations are hand-checked.

### 5.1. Sample construction

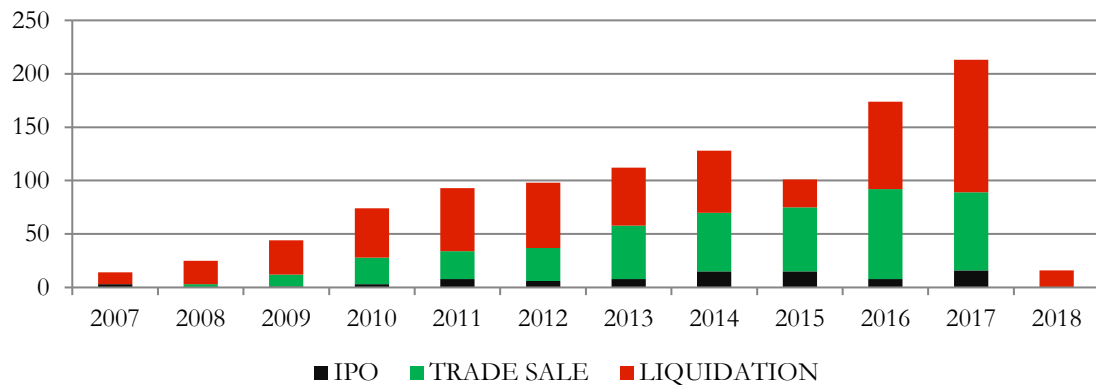
Our database is made up of VC financed deals, each deal pertaining to one investment round in a given VC-backed firm which is located in EU 28 region, as defined by the country of their headquarters; but we have no restrictions on the country of origin of the VC fund. The empirical analysis of the paper is done per round as we model the time-to-exit since a given financing round and taking into account the characteristics of the funding that took place at that time. Also, we include the variables of market conditions. Observations cover the period from 1<sup>st</sup> January 2007 to 31<sup>st</sup> December 2017. We obtained the data in this paper from several sources and databases in a complex and multi-step process. We restrict the sample to those investments where it is possible to (1) identify the venture-backed firm and fund(s) involved, (2) identify the completed-confirmed or completed-assumed date of VC funding, and (3) obtain data for the deal value for each investment round.<sup>18</sup>

The first step in building the database is to identify VC exits. Zephyr contains information on deals date for IPOs and trade sales. A VC-backed firm is considered to be liquidated if its status was on 21<sup>st</sup> February 2018 (date at which the data has been collected) one of the following: “bankruptcy”, “dissolved”, “dissolved (bankruptcy)”, and “dissolved (liquidation)”, “in liquidation”. The exit date for liquidation was gathered by hand from the Amadeus database. Those companies who did not have available information, we assume the exit date as the target latest accounts date.

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<sup>18</sup> When more than one investment round occurred at the same time, all rounds were merged into one round. Note that the financing round is considered only in the occurrence of one venture-backed firm and if there is information for all financing rounds during the period of our study, otherwise all rounds for a VC-backed firm are eliminated. This is important to avoid bias in the analysis of the study.

The second step involves filtering observations by deal dates which occurred after the first exit. Therefore, observations until the first exit are kept. After combining two databases, from the 13,850 VC funded investment rounds from January 2007 to December 2017 we are able to collect data required for 6652 deals. It gives 83 IPOs, 418 trade sales, and 591 liquidations out of 5461 VC-backed firms. Figure 1 shows the exit route distribution by year.



**Figure 1.** Exits distributions by route and year. This figure shows only our sample of 1092 exits, excluding other routes and unexited VC-backed firms.

In the following section, we summarize the definitions of our variables, and how they have been constructed. This paper considers three sets of variables that could influence the timing of exit and the choice of exit route, split into entrepreneurial firm-related variables, VC firm-related variables, and market conditions. The entrepreneurship and VC characteristics were collected from Zephyr and Amadeus databases. Additionally, CrunchBase, Bloomberg and companies' websites were used in order to obtain the year of foundation.

### 5.1.1. Entrepreneurial firm-related variables

Type of exit (dummy variable): IPO (IPO exit), TRADESALE (trade sale exit), LIQUIDATION (liquidation exit). Set to 1 if the firm exited according to the exit specified by the variable. Firms that are characterized by IPO=0, TRADESALE=0 and LIQUIDATION=0 has yet not exited and will only enter the likelihood through its survivor function.

Industry type (dummy variable): MANUFAC (manufacturing), COMPUTER (hardware and software), BIOPHARMAC (biotechnology and pharmaceuticals), COMMEDIA (communication and media), WHOLERETAIL (wholesale and retail), FINANCE (finance,

insurance and real estate) and OTHERIND (other industries than those listed above). These variables are equal to 1 if the given firm belongs to the specified industry.

Geographical location of the entrepreneurial firm (dummy variable): NORTHERN (Sweden, Denmark, Finland, Lithuania, Latvia, Estonia); SOUTHERN (Cyprus, Greece, Italy, Malta, Portugal, Spain); WESTERN (Austria, Belgium, France, Germany, Ireland, Luxembourg, Netherlands, UK); and CENTRALEASTERN (Bulgaria, Czech, Croatia, Hungary, Poland, Romania, Slovakia, Slovenia). Set to 1 based if the region matches the description of the variable in which venture capital funds are committed. This classification of regions is based on EuroVoc<sup>19</sup>. We also divided firms into 28 European countries, which are presented only in the descriptive analysis as the regions are quite homogeneous and do not have significant value in our estimation results.

The total amount of money received by the firm at the given round (in millions of EUR): AMOUNT. All the estimated deal values were considered in our analysis as well.

The number of days elapsed between the date at which the round began and the exit date if there was an exit: DURATION. The time to exit is measured as the difference between a VC investment date and the date of exit from an investment. If the firm has not exited, this variable gives the number of days elapsed between the date at which the round began and the date of the data collection (February 21<sup>st</sup>, 2018).<sup>20</sup> This variable is the main focus of our analysis as in Giot and Schwienbacher (2007) paper since it characterizes the life of the investment since a given round until the exit.

### **5.1.2. Venture capital firm-related variables and market conditions**

Syndicate size that is the number of VC firms that participated in that financing round: SYNDSIZE.

Age (in years) of the oldest VC firm in the syndicate at the time of investment round date: AGEOLDESTVC.

Dummy variable equal to 1 if at least one VC firm in the syndicate is in the same country as the entrepreneurial firm: SAMECOUNTRYVC.

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<sup>19</sup> The Publications Office of the European Union. For more information about the institution, see <https://publications.europa.eu/en/web/eu-vocabularies>.

<sup>20</sup> The duration of such rounds is called right-censoring. Censoring arises when the event of interest occurs at a time outside the time interval of the study.

In addition, the selection variable (round number) is ROUND that indicates which financing round we are dealing with. We also include a measure of stock market liquidity, namely the return of the Euronext 100 Index. Information about the stock market return index is collected from its official website. Finally, the measure of debt market condition, the *FED tightening Index*<sup>21</sup>, is collected from the Board of Governors of Federal Reserve System website and represents the net percentage of domestic banks that have tightened standards for Commercial and Industrial loans to small firms in a quarter. All macroeconomics variables are recorded 3 months (90 days) before the exit because such decisions are made some time before the transaction closes.

## 5.2. Descriptive analysis

In this section, we present the descriptive analysis of our sample. Table 1 provides descriptive statistics and the macroeconomic variables at the time of the exit, which also reports the differences to the sub-sample of deals, using the two-sample Wilcoxon rank-sum (Mann–Whitney) test. The main summary of statistics for our sample is presented in Table 2. Table 3 provides the frequency of exit routes for different industries, countries and regions. Table 4 gives a breakdown of syndication size, amount and duration by investment rounds and industries for exited firms. The correlation matrix with associated variables is presented in Appendix 1. Majority of the values in the correlation matrix are less than 0.5 suggesting that there are no issues with correlations. The only exceptions are the correlations between Western, Northern and Southern Europe region variables.

In Table 1 we differentiate between exit routes. Panel A shows that investments exited through an IPO last on average (median) for 3.7 years (3.5 years), compared with 3.8 years (3.5 years) and 3.3 years (2.7 years) for trade sales and liquidations respectively. The duration differences between the sub-sample of first-round deals exited through a liquidation and a trade sale are statistically significant at the 1% level. Panel B reports, however, that duration differences between the sub-samples of all investment rounds exited through an IPO, trade sale and liquidation are statistically significant at the 1% level. The average (median) duration between rounds is 3.3 years (2.9 years) for investments exited through an IPO, compared with 3.8 years (3.5 years) for a trade sale and 3.2 years (2.7 years) for a liquidation. It suggests that VC firms that repeatedly invest money in one

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<sup>21</sup> Senior Loan Officer Opinion Survey on Bank Lending Practices. For more information, see <http://www.federalreserve.gov/boarddocs/SnLoanSurvey/>

company after a short period of time tend to exit via liquidation, which may be caused by too little monitoring and screening of an entrepreneurial firm. The amount of money invested, syndicate size and VC firm experience are significantly different between exit routes for the first round as well as all investment rounds. The difference between trade sales and liquidations in terms of the stock market condition is statistically different, but the debt market condition has no significant difference related to the choice of the exit.

**Table 1**

Summary statistics for each exit subsample (only numerical variables). Panel A provides the average and median values for the first investment round (by focusing on the first round, we make sure that each exited company is represented once). Panel B reports the same for all investment rounds of exited companies. \*, \*\*, \*\*\* indicate that the two sub-samples are significantly different at the 10%, 5%, and 1% level, respectively.

Variables	IPO		Trade sale			Liquidation		
	Average	Median	Average	Median	z	Average	Median	z
<i>Panel A: First investment round (Round = 1)</i>								
DURATION (days)	1365.4	1273.0	1392.3	1270.0	1.1	1202.4	999.0	5.7***
AMOUNT (million euros)	10.995	5.300	5.806	2.000	-5.6***	2.270	0.939	7.9***
SYNDSIZE (#investors)	3.1	2.0	2.3	2.0	-4.6***	1.8	1.0	3.1***
AGEOLDESTVC (years)	19.9	18.0	15.1	12.0	-4.3***	13.2	10.0	1.9*
Fed tightening index	-3.3	-4.2	-1.6	-4.1	1.3	1.2	-4.1	0.2
Euronext return	2.9	3.0	2.1	3.0	-0.7	2.7	4.3	-3.2***
<i>Panel B: All investment rounds</i>								
DURATION (days)	1197.7	1042.0	1392.3	1270.0	2.7***	1183.0	972.0	5.5***
AMOUNT (million euros)	15.677	7.700	5.806	2.000	-7.1***	2.306	1.000	8.9***
SYNDSIZE (#investors)	3.4	3.0	2.3	2.0	-5.8***	1.9	1.0	3.9***
AGEOLDESTVC (years)	21.4	20.0	15.1	12.0	-5.5***	13.6	10.0	2.8***
Fed tightening index	-3.6	-4.2	-1.6	-4.1	1.7	0.6	-4.1	0.7
Euronext return	2.8	3.2	2.1	3.0	-0.5	2.7	4.0	-2.6***

Table 2 provides summary information for the 6652 deals. There is little variation in the different subsamples in terms of VC firm characteristics, except the VC firm experience (AGEOLDESTVC variable), which is about 5 years longer in case of an IPO exit than other exit routes. Besides, most of the VC firms are investing in their home country.<sup>22</sup> This

<sup>22</sup> This is supported by many papers who found that VCs invest in geographically proximate entrepreneurial firms. For instance, Johan and Cumming (2006), Lerner (1995).

may stem from tax (risk of double taxation) and legal issues, since the European VC market experience high fragmentation across national borders (Kraemer-Eis et al., 2016). The deal syndication size results are aligned with Schwienbacher (2005) and Hege et al. (2009) findings that the average size of syndicates is larger in the U.S. than in Europe. The average investment deal syndication size is on average 4 in the U.S. according to Giot and Schwienbacher (2007) study and 4.5 by (Schwienbacher, 2008). However, Schwienbacher (2008) found that syndication size in Europe is 2.7 and Hege et al. (2009) 2.8 on average, which is bigger than in our sample that is 2 syndicate partners.

The duration of investment was the shortest for liquidations (3.3 years) and longest for trade sales (4 years). At the same time, the average amount of money received by the firm is the highest for an IPO, which is about two (five) times higher than a trade sale (liquidation).

Overall, more than half of the entrepreneurial firms in our sample are located in Western Europe. The next largest region is Southern Europe. Comparing exited with not-yet-exited investment rounds with respect to regions; those located in Western Europe have a higher proportion of exited rounds. Regarding geographical location by countries (see Appendix 2), the VC market is most active in the United Kingdom and France as they have the highest proportion of VC investments. France has the highest proportion of successful exits – 49.4% of firms exited through an IPO and 19.6% through a trade sale. This is aligned with Black and Gilson (1998) – countries with larger stock markets have more IPOs than trade sales. However, 36.4% of VC firms in the United Kingdom have been liquidated.

Majority of the VC firms are in communication and media industry (43.3%), followed by computer (18.4%), biotechnology and pharmaceuticals (15.4%), in which exits occur the most as well. We see that, for biotechnology and pharmaceutical investments, the fraction of deals that exited through an IPO is quite large compared to its relative importance (51.8% of all IPOs are biotechnology and pharmaceutical investments while exited deals of the industry only account for 19.7% of the total sample).

**Table 2**

Dataset: main summary statistics (mean of variable). This table provides averages of variables for various sub-samples: first round investments only, the full sample (i.e., all rounds), exited rounds only including each exit route separately), and un-exited rounds with (unknown) other rounds only.

Variable	Full sample		Exited rounds only								Unexited rounds only and other exits	
	First round	All rounds	All routes		IPO		Trade sale		Liquidation		First round	All rounds
			First round	All rounds	First round	All rounds	First round	All rounds	First round	All rounds		
<b><i>VC firm characteristics</i></b>												
SYNDSIZE (#investors)	1.876	2.035	2.009	2.167	3.084	3.376	2.067	2.250	1.802	1.882	1.845	2.002
AGEOLDESTVC (years)	14.387	15.051	14.114	14.903	19.891	21.368	14.237	15.069	13.217	13.595	14.456	15.088
SAMECOUNTRYVC	0.870	0.870	0.879	0.884	0.916	0.904	0.876	0.878	0.876	0.886	0.868	0.867
<b><i>Entrepreneurial firm-related variables</i></b>												
<i>Industry dummies</i>												
DURATION (days)	–	–	1314	1267	1365	1198	1462	1392	1202	1183	–	–
AMOUNT (million euros)	3.419	4.006	4.223	4.935	10.995	15.679	5.640	5.806	2.270	2.306	3.218	3.773
<i>Geographical location of VC-backed firm by regions</i>												
NORTHERN	0.119	0.119	0.104	0.107	0.096	0.096	0.110	0.107	0.102	0.110	0.122	0.121
SOUTHERN	0.146	0.144	0.138	0.136	0.036	0.024	0.124	0.130	0.162	0.161	0.149	0.146
WESTERN	0.671	0.679	0.724	0.727	0.819	0.824	0.730	0.732	0.707	0.705	0.658	0.855
CENTRALEASTERN	0.064	0.058	0.033	0.030	0.048	0.056	0.036	0.031	0.029	0.025	0.071	0.065

Table 3 shows that the proportion of exit types is roughly similar across industries and regions with two exceptions. Firstly, firms in the biotechnology and pharmaceuticals

**Table 3**

The frequency of exit route for different type of industries and countries. Panel A gives the exit routes frequencies by industry for the first investment round. Panel B provides similar summary statistics for all investment rounds of exited companies. Panel C and D data are presented the same as previously, except for regions. Column 2 gives the number of observations per industry and region for which an exit already occurred. The last two columns give the ratio of trade sales over IPOs and liquidations, accordingly. Since we exclude yet-to-exit investments, the total number of observations is 1092 for Panel A and C, and 1332 for Panel B and D.

Variable	No. Obs.	Exit route			Ratio TS- IPO	Ratio TS- LQ
		IPO (%)	Trade sale (%)	Liquidation (%)		
<i>Panel A: First investment round (Round = 1)</i>						
MANUFAC	104	9.6	27.9	62.5	2.9	0.4
COMPUTER	288	3.1	34.0	62.8	10.9	0.5
BIOPHARMAC	215	20.0	34.9	45.1	1.7	0.8
COMMEDIA	333	3.3	48.3	48.3	14.6	1.0
WHOLERETAIL	43	7.0	34.9	58.1	5.0	0.6
FINANCE	24	12.5	25.0	62.5	2.0	0.4
OTHERIND	85	4.7	40.0	55.3	8.5	0.7
<i>Panel B: All investment rounds</i>						
MANUFAC	124	12.1	28.2	59.7	2.3	0.5
COMPUTER	358	3.1	34.4	62.6	11.2	0.5
BIOPHARMAC	280	24.6	35.4	40.0	1.4	0.9
COMMEDIA	404	4.5	51.2	44.3	11.5	1.2
WHOLERETAIL	48	8.3	37.5	54.2	4.5	0.7
FINANCE	27	11.1	22.2	66.7	2.0	0.3
OTHERIND	91	5.5	38.5	56.0	7.0	0.7
<i>Panel C: First investment round (Round = 1)</i>						
NORTHERN	114	7.0	40.4	52.6	5.8	0.8
SOUTHERN	151	2.0	34.4	63.6	17.3	0.5
WESTERN	791	8.6	38.6	52.8	4.5	0.7
CENTRALEASTERN	36	11.1	41.7	47.2	3.8	0.9
<i>Panel D: All investment rounds</i>						
NORTHERN	143	8.4	39.2	52.4	4.7	0.7
SOUTHERN	181	1.7	37.6	60.8	22.7	0.6
WESTERN	968	10.6	39.6	49.8	3.7	0.8
CENTRALEASTERN	40	17.5	40.0	42.5	2.3	0.9

industry are exiting more frequently through IPOs than any other exit route. Second, the Southern region has much fewer IPOs and more liquidations than any other region. In all panels, the ratio of trade sales over IPOs is always greater than 1. For example, there are two times more trade sales than IPOs in the finance, insurance and real estate industry. The ratio of trade sales over liquidations gives insight that liquidations surpass IPOs and trade sales, especially in the finance, insurance and real estate industry.

A breakdown of AMOUNT and SYNDSIZE by round number (Panel A of Table 4) shows that the amount invested increases steadily up to 5th round. Thereafter it decreases significantly, which is due to the lack of data of VC-backed firms with more than 5 investment rounds. This finding is consistent with the literature as VCs do not want to invest too many funds at the start of the VC process. The average number of VC firms investing in jointly appears to be lower for the first rounds and is the highest for round 3 and round 4. It is similar to Lerner (1994a) results that syndication size tends to increase by rounds. The rationale behind is that the choice of syndication partners is less critical in later rounds. In general, the durations for successful exits (IPOs and trade sales) decreases as the number of rounds increases, which is in line with the literature that assumes a reduction in duration as the project is developed. For example (IPO and TS), the average duration goes from 3.96 years (1446 days) to 2.33 years (851 days) as the representative firm goes from round 1 to round 5. However, the duration is quite different for liquidations, that is decreasing up to round 3 but then it is the longest in round 4. Beginning from the 1st round of investment, exit through liquidation occurs in 3.29 years, while IPO (trade sale) takes 3.74 years (4 years), and since the 4th round, the exit takes 4.83 years (1765 days). This might be due to the fact that VC firms are still trying to make effort to gain back their investments and thus prolong the exit. Opposite to Schwienbacher (2005) findings, round durations are shorter than in study(ies) by Giot and Schwienbacher (2007).

The breakdown of firms across industries (Panel B of Table 4) shows that communication and media industry attracts the substantial part of the VC invested, while financial companies are much less represented. From the breakdown of the invested amount of money by industry, we can observe that the average biotechnology and pharmaceutical firms were given more money (around €7.438 million) than other types of firms.

**Table 4**

Summary statistics for the investment rounds and industries. Key statistics for different investment rounds and industries. AMOUNT is expressed in €1,000,000 which is the amount of money received by the firm. SYNDSIZE is the size of the syndicate. Standard deviations are reported below each value in the brackets.

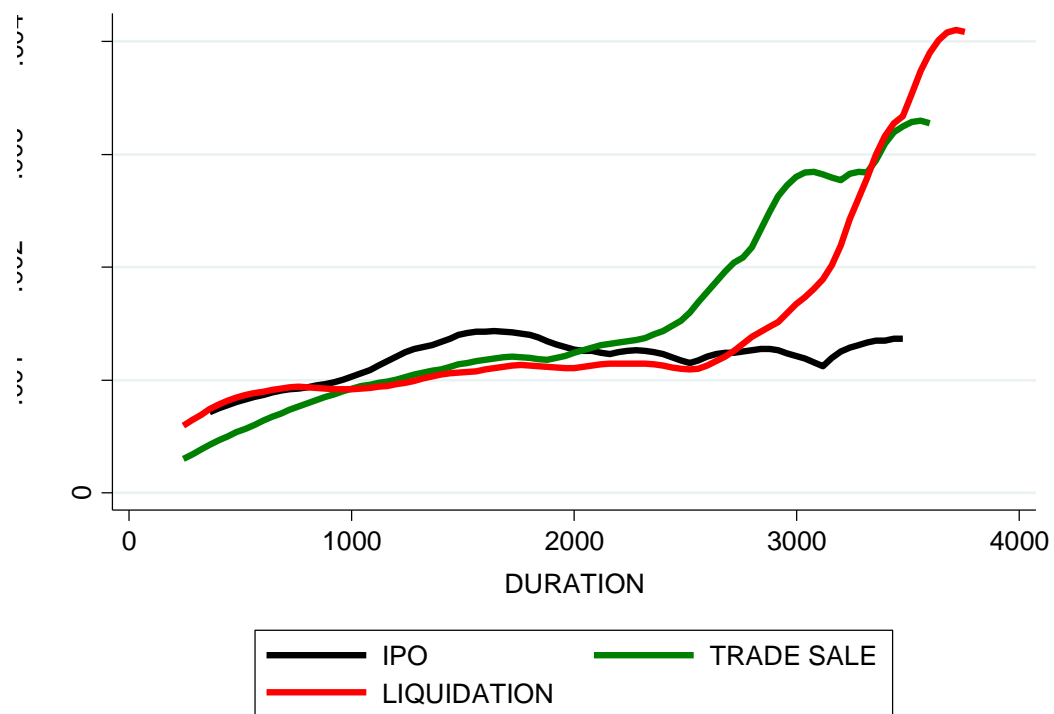
Variable	No.obs.	Amount	Syndsize	Duration (in days)			
				IPO	TS	IPO and TS	Liquidation
<i>Panel A: Breakdown by investment rounds</i>							
All rounds	6652	4.006 (0.145)	2.0 (0.02)	1198 (77)	1392 (35)	1355 (32)	1183 (34)
1st round	5461	3.419 (0.152)	1.9 (0.18)	1365 (99)	1462 (40)	1446 (37)	1202 (37)
2nd round	938	5.891 (0.440)	2.6 (0.06)	930 (125)	1156 (70)	1083 (61)	1078 (91)
3rd round	196	9.810 (1.093)	3.4 (0.16)	752 (204)	973 (135)	896 (112)	779 (206)
4th round	41	9.023 (1.715)	3.4 (0.28)	299 (47)	1451 (191)	875 (342)	1765 (250)
5th round	12	10.792 (5.593)	2.8 (0.42)	– –	851 (96)	851 (95)	– –
6th round	3	6.056 (2.732)	3.0 (1.15)	– –	– –	– –	– –
7th round	1	– –	– –	– –	– –	– –	– –
<i>Panel B: Breakdown by industries</i>							
MANUFAC	576	3.089 (0.353)	2.0 (0.06)	1333 (265)	1567 (136)	1497 (124)	1263 (112)
COMPUTER	1210	2.979 (0.184)	2.1 (0.04)	994 (174)	1438 (73)	1402 (69)	1228 (59)
BIOPHARMAC	1116	7.438 (0.502)	2.8 (0.06)	1252 (107)	1484 (80)	1388 (65)	1429 (92)
COMMEDIA	2889	2.815 (0.153)	1.9 (0.02)	1043 (203)	1315 (55)	1293 (53)	958 (52)
WHOLERETAIL	227	4.469 (1.010)	1.7 (0.06)	1873 (398)	1193 (168)	1317 (161)	943 (146)
FINANCE	172	6.714 (1.275)	1.7 (0.09)	609 (485)	801 (217)	737 (201)	1389 (286)
OTHERIND	462	5.751 (0.974)	1.7 (0.05)	862 (162)	1461 (143)	1386 (130)	1171 (119)

Finance, insurance and real estate firms rank second (mean of €6.714 million), while the other firms received on average around €2.8–5.8 millions. The mean of syndicate size is

quite similar across the industries and there is little variability in the means. Focusing on the duration among successful exits, average finance, insurance and real estate firms had the fastest exit through an IPO (1.7 years) and trade sale (2.2 years). Firms in the other industries needed nearly twice as much more time, the slowest being the manufacturing firms (mean of duration is 4.1 years). When focusing on liquidations, this time finance, insurance and real estate firms take the longest time to exit (3.8 years). The wholesale and retail firms have the fastest exit, taking on average 2.6 years to be liquidated.

## 6. Estimation results

In order to understand exit dynamics during the life of investment rounds, we next analyse the time-to-exit using survival analysis framework. **Erro! A origem da referência não foi encontrada.** compares the exit routes through IPO, trade sale and liquidation. The hazard function gives the conditional instantaneous probability of exit given that the deal has not been exited at that specific time. The x-axis denotes the number of days elapsed, while the y-axis presents the hazard rate (conditional exit probability).



**Figure 2** Hazard functions by exit routes

The hazard functions provide evidence on the dynamics of the exit process. First, the exit probabilities are broadly similar for the first 900 days (2.47 years) of the VC fund, although trade sales are less likely during this initial period. Second, thereafter the probability of exiting via IPO increases more than other routes. In the 5-6 year period (2100 days), the trade sale exit is more likely than the IPO and liquidation exit. Therefore, the results support a previous study (Cumming and MacIntosh, 2003b) that the IPO exit is the preferred route for VCs in the short run. Generally, VCs rely on trade sale exits for more mature firms or those that failed to go public earlier. Third, as the investment holding period increases, the probability of IPO and trade sale exit diminishes. Overall, successful

firms that could not go public sufficiently quickly have to rely on other exit routes like trade sales. Subsequently, VCs exit their investments through liquidation. By looking independent hazard rates for each exit route, we can see that IPO hazard rate stays relatively flat during the observed period, with a small hump during 2.5 to 5.5 years of investment (900–2000 days). The hazard rate for trade sale exit increases steadily around 7 years ( $\approx 2500$  days), as the entrepreneurial firm matures, and then rises fast with two small humps. Liquidation hazard rate shows that firms tend to be liquidated neither in the very beginning of the investment or at the latest when firms have failed to exit via IPO or trade sale. The former of the case is consistent with Cumming and MacIntosh (2001) that liquidations occur after the shortest investment duration (i.e. the ‘lemons’ are quickly discarded, while the ‘plums’ are maintained to mature).

As indicated in Section 4, we use Gamma density function as the distribution for the underlying term. We checked the best model-fitting for each possible distribution and concluded that the general Gamma density function is one of the best fit for our model (see Appendix 3). Additionally, it is more flexible to characterize all distinct exit routes. We avoid multicollinearity problems by not including the OTHERIND (other industries) and CENTRALEASTERN variables. In order to check the robustness of our results, we also estimated the semi-parametric Cox proportional hazard model with the same explanatory variables. The results were qualitatively similar (see Appendix 4).

Table 5 shows the estimation results for all exits, IPO, trade sale and liquidation. This table features three panels: the top panel presents estimation results for the entrepreneurial firm-related variables; the second panel displays the outputs for the VC firm-related variables; while the bottom panel presents market condition variables. We acknowledge that not all trade sales are successful (e.g. in the case of fire sales), or investments that have not been exited are not necessarily unsuccessful. Let us now analyse the impact of each variable on the time to exit.

### **6.1. IPO exit**

Results in the top panel of Table 5 show that BIOPHARMAC firms have a significantly fast exit. However, estimation results for the industry variables do not show a significant effect in general. The larger investment level decreases the IPO exit time (significantly negative AMOUNT coefficient).

**Table 5**

Estimation results. Estimated coefficients for the accelerated failure time model set in the framework of competing risks with three exits (IPO, trade sale, liquidation). The duration (time-to-exit) is the number of days between the start at the given financing round and the time of the exit. Non-exited firms are taken into account as the model treats their duration as being right-censored at the date of the data collection (February 21<sup>st</sup>, 2018). The specified underlying density distribution for the durations of the model is the generalized Gamma density distribution. \*, \*\* and \*\*\* indicate that coefficient is significant at 10%, 5% and 1% respectively.

Variable	IPO	Trade sale	Liquidation
<i>Entrepreneurial firm-related variables</i>			
MANUFAC	-0.607	0.209	-0.250
COMPUTER	0.441	0.061	-0.190
BIOPHARMAC	-1.151*	0.144	0.020
COMMEDIA	0.159	-0.332***	-0.101
WHOLERETAIL	-0.619	-0.124	-0.259
FINANCE	-1.031	0.270	-0.109
AMOUNT (million euros)	-0.018***	-0.005***	0.037***
NORTHERN	1.244**	-0.148	-0.411*
SOUTHERN	2.337***	-0.058	-0.530*
WESTERN	0.987*	-0.139	-0.577***
<i>VC-related variables</i>			
SYNDSIZE (#investors)	-0.152*	-0.052**	0.040
AGEOLDESTVC (years)	-0.024*	-0.003	0.002
SAMECOUNTRYVC	-0.003	0.128	0.223*
<i>Market condition variables</i>			
Fed tightening index	-0.046***	-0.042***	-0.072***
Euronext return	-0.177***	-0.094***	-0.176***

As far as the regional location of the entrepreneurial firm is concerned, firms in Western Europe tend to go public faster than firms in the Northern and Southern Europe. The difference is quite significant when switching from a Western firm to Southern firm, as shown by the time ratios ( $e^{0.987}/e^{2.337}=0.259$ ). Even though the Western Europe firms are more likely to exit through an IPO, the coefficient is still positive, which means a decreased likelihood of the exit.

Regarding VC-related variables, SYNDSIZE and AGEOLDESTVC coefficients are significantly negative. Thus larger syndicate size and more experienced VCs decrease the exit time. This supports our hypothesis that more syndicate partners help to add value and

accelerate the exit. However, our results do not support the hypothesis that younger (i.e. less experienced) VC firms are more likely to exit through an IPO. Regional proximity (SAMECOUNTRYVC variable) does not impact the likelihood of an IPO.

Market conditions have a strongly significant impact on the IPO probability, as well as on all other exit routes. This is in line with earlier studies on the liquidity of stock markets and supports the notion that stock markets conditions are important factors for venture capital markets (Black and Gilson, 1998). The Euronext market return in a quarter before significantly reduces the time for an IPO, as well as *FED tightening index*, although market return increases the likelihood of faster exit more than debt market condition.

## **6.2. Trade sale exit**

Communication and media firms are the only ones that show a significant decrease in exit time. As expected, larger committed funds are more likely to exit faster through a trade sale. The geographical location of the entrepreneurial firm has no significant differences between European regions, although firms in Southern Europe do exit much less frequently. Regarding VC-related variables, a larger syndicate size increases the hazard for the trade sale, and thus decreases the exit time. Further variables related to value-adding such as VC firm experience and geographical proximity do not impact the likelihood. The effects of market condition variables are strongly significant and support our assumption that good debt market condition increases the likelihood for the trade sale.

## **6.3. Liquidation exit**

Estimation results for the industry variables have no significant effect on liquidation exits. As we earlier hypothesized that VCs do not want to lose their investments and tend to prolong the duration, the committed amount of money significantly increases the time-to-exit. All regions have a significant impact on the liquidation, which could suggest that regardless of the geographical location of the entrepreneurial firm, VCs know when it is time to abandon their projects. With respect to Western Europe firms, firms in Northern Europe exhibit a relative time ratio of 1.403 (computed as  $e^{-0.577}/e^{-0.411}$ ), which means entrepreneurial firms in Western Europe are liquidated 1.4 times faster than in Southern Europe. Concerning VC-related variables, only the regional proximity of VC firm has a positive significant effect, which disproves our hypothesis that proximity increases the

chance of successful exit due to better networking. The market conditions are also significant for liquidation exits.

When comparing all the exit routes, we can conclude that there is no industry effect for European VC exit market as it was strongly significant in the U.S. firms found in Giot and Schwienbacher (2007) study. However, we found that there are statistically significant differences between European regions for IPOs and liquidations. VCs who have invested in Western entrepreneurial firms are exited faster than those invested in Northern and Southern firms. The longest duration for a trade sale exit is in Southern and for a liquidation in Northern Europe. As expected, the larger amount of investment increases the likelihood and decreases the investment duration for IPO and trade sale exits. The syndicate size has a statistically significant effect for IPO and trade sale exits as well whereas it does not affect liquidations, which we expected to have the same effect. The syndication is more pronounced for IPO exit than for trade sale exit. For instance, increasing the syndicate size from 2 to 4, results in median exit time decreases about 19% for IPO and 9% for a trade sale.

The experience of the oldest VC firm in syndicate only has a statistically significant impact on the IPO duration. It shows that VCs with more experience have shorter investment durations, which do not support the grandstanding theory by Gompers (1996). One possible interpretation for this unexpected result is the difference between European and American VC market – capital markets in EU are not as liquid as in the U.S. and it needs more experience from VCs who are taking firms public. Surprisingly, the regional proximity has a negative effect only for a liquidation exit as it decreases the time-to-exit. Market conditions are found to be significant for all exit routes: the probability of choosing an IPO, over liquidation and trade sale, is higher when the stock market has been increasing. These results support our expectation that during a ‘hot’ market period bad project are abandoned quickly to focus on exiting via IPO. Although equity market conditions have a stronger effect on all types of exit routes, the better debt market condition (lower/more negative index means easier access to debt) increases the likelihood for trade sales.

## 6.4. Related results

The analysis based on competing risks model has provided some interesting results about exit dynamics in the European VC market. Here we briefly discuss the similarities and differences in our findings between previous literature on this topic.

Gompers (1995) finds evidence in an agency and monitoring framework that firms who receive a higher amount of investments (i.e. smaller degree of information asymmetry) are more likely to exit through an IPO rather than a trade sale and liquidation. Our study provides similar results in line with this rationale. Further, we suggested that larger committed funds slow down the decision to abandon a project not to lose money invested.

Nahata (2008) finds that more reputable VCs, which we consider as the age of the oldest VC firm in our work, are more likely to exit through an IPO and access public markets faster. Our study found the same effect for more experienced VCs, however, it did not provide further evidence for trade sale and liquidation exits. Cumming and MacIntosh (2001) results support both our results as they suggest that VCs may choose to exit their investments prematurely (i.e. faster) for all exit types if planning to establish a new fund. Lerner (1994b) also finds that experienced VCs invest in the later rounds of deals (called “window dressing”, i.e. firm’s valuation increases after established funds join the syndicate) particularly to go public. Those results are different from the earlier study done by Gompers (1996) grandstanding theory.

In line with previous works, the liquidity of stock market is an important factor affecting exit outcomes. Our results identify that more liquid stock market conditions affect the dynamics of exit choices by accelerating time-to-exit for all exit routes. This is aligned with one of the most important paper about the structure of capital markets by Black and Gilson (1998), who argue that active stock markets allow VCs to exit easily. The results are also in line with study by Cumming et al. (2005) that provides evidence how VCs adjust their investment rationales to changes of stock market liquidity conditions. We further tested debt market conditions and it has similar results.

Our work sheds light on European VC exits, which up to our knowledge is not done before in the competing risks model framework with chosen variables that characterize the entrepreneurial and VC firm and market conditions. According to our results, entrepreneurial firms in biotechnology and pharmaceutical industry are likely to exit faster

through an IPO, while communication and media firm have strong likelihood to exit through a trade sale. Furthermore, Western Europe firms have the most active VC industry as they have faster exits than other regions in Europe. Conversely to Giot and Schwienbacher (2007) findings, European firms do not have a strong industry effect. Also, the regional proximity of VC firm does not affect trade sales instead it increases the time for liquidations.

## 7. Conclusions

Using survival analysis methods in the competing risks model framework, we examined simultaneously the type and the timing of the exit for the IPO, trade sale and liquidation in the European venture capital market. We considered the data for 6652 investment rounds from 5461 VC-backed firms in EU 28 region from several sources and databases in a multi-step process.

Our empirical results show that macroeconomic conditions are found to be most significant for all exit types. The better stock market conditions, the more likely VCs are exiting through an IPO, followed by liquidation and trade sale. Our analysis suggests an exit order, starting with IPO and then possibly a trade sale. The time until a liquidation is extended until there is no window of opportunity for IPOs and trade sales.

The degree of value-adding by VC firms also impacts the exit strategy. We find that larger syndicate size accelerates exit for IPOs and trade sales, with the greatest impact for IPO. The proximity of at least one VC fund makes liquidations more likely, suggesting that greater control by VC firms is related to more liquidation. Our third measure of VC value-adding indicates that the more experienced VC firms can take companies public faster whereas it does not affect other exit routes.

Regarding industries, our results suggest that there are no significant differences in terms of exit routes and timing between industries. Nevertheless, we found that there is some variance between European regions for IPO and liquidation exit, while the location of the entrepreneurial firm has no significant effect on the trade sale. The Western Europe firms have faster exits through an IPO and liquidation compared to other regions. It is suggestive that the Western part of Europe has more active and experienced venture capital market to help screen companies and depart from “bad” firms quicker.

Our work is inspired by previous studies, and enriched by our contribution with some new insights on the European venture capital market. For future research we suggest extending the time of analysis by up to 20 years to have more exhaustive information in terms of investment rounds. In addition, the regional proximity of VC firm could be measured as the percentage of syndicate size, which may give more statistically significant results.

# Appendix

## Appendix 1. Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	
(1) DURATION	1																					
(2) IPO	-0.028	1																				
(3) TRADESALE	-0.002	-0.040	1																			
(4) LIQUIDATION	-0.074	-0.047	-0.099	1																		
(5) MANUFAC	0.050	0.016	-0.020	0.026	1																	
(6) COMPUTER	0.170	-0.034	0.040	0.128	-0.145	1																
(7) BIOPHARMAC	0.119	0.142	0.017	-0.004	-0.138	-0.212	1															
(8) COMMEDIA	-0.267	-0.081	-0.023	-0.118	-0.270	-0.413	-0.393	1														
(9) WHOLERETAIL	0.021	-0.002	0.001	0.007	-0.058	-0.089	-0.084	-0.165	1													
(10) FINANCE	-0.019	-0.002	-0.027	0.001	-0.050	-0.077	-0.073	-0.143	-0.031	1												
(11) OTHERIND	0.030	-0.016	-0.003	0.007	-0.084	-0.129	-0.123	-0.239	-0.051	-0.045	1											
(12) AMOUNT	-0.021	0.137	0.045	-0.049	-0.024	-0.041	0.131	-0.088	0.007	0.037	0.040	1										
(13) NORTHERN	-0.032	-0.010	-0.010	-0.009	0.004	0.015	-0.014	0.044	-0.036	-0.036	-0.044	-0.038	1									
(14) SOUTHERN	-0.025	-0.047	-0.012	0.016	-0.020	-0.033	-0.065	0.059	0.055	0.003	0.011	-0.044	-0.150	1								
(15) WESTERN	0.031	0.043	0.033	0.019	0.022	0.004	0.097	-0.102	-0.009	0.025	0.019	0.091	-0.534	-0.597	1							
(16) CENTRALEASTERN	0.020	-0.001	-0.035	-0.048	-0.020	0.022	-0.076	0.055	-0.015	-0.004	0.005	-0.064	-0.091	-0.102	-0.362	1						
(17) SYNDSIZE	-0.050	0.128	0.043	-0.036	-0.008	0.006	0.237	-0.111	-0.049	-0.039	-0.072	0.269	-0.024	-0.081	0.154	-0.153	1					
(18) AGEOLDESTVC	-0.087	0.078	0.001	-0.044	0.017	0.005	0.174	-0.106	-0.029	-0.015	-0.047	0.209	0.021	-0.047	0.123	-0.203	0.486	1				
(19) SAMECOUNTRYVC	0.035	0.014	0.006	0.016	0.058	0.016	0.076	-0.097	-0.014	-0.042	0.024	-0.062	-0.037	0.027	0.068	-0.124	0.131	0.119	1			
(20) FED tightening index	-0.080	0.068	0.226	0.367	0.004	0.085	0.016	-0.091	0.003	0.014	0.010	0.021	-0.002	-0.004	0.027	-0.044	0.008	-0.012	0.017	1		
(21) Euronext return	-0.023	0.157	0.264	0.368	0.008	0.063	0.031	-0.073	-0.001	-0.011	-0.001	0.009	-0.011	0.019	0.009	-0.031	0.031	-0.003	0.014	-0.075	1	

## Appendix 2. Summary statistics for geographical location of VC-backed firms by country

This dataset is the extension for Table 2. (mean of variable). Other 13 countries include Croatia, Czech Republic, Cyprus, Estonia, Greece, Lithuania, Latvia, Luxembourg, Malta, Portugal, Romania, Slovakia, and Slovenia.

Variable	Full sample		Exited rounds only								Unexited rounds only and other exits		
	First round	All rounds	All routes		IPO		Trade sale		Liquidation		First round	All rounds	
			First round	All rounds	First round	All rounds	First round	All rounds	First round	All rounds			
<i>Country of VC-backed firm</i>													
United Kingdom	0.269	0.285	0.309	0.321	0.145	0.168	0.263	0.283	0.364	0.377	0.259	0.276	
France	0.236	0.228	0.231	0.224	0.494	0.464	0.196	0.184	0.218	0.212	0.238	0.229	
Spain	0.097	0.096	0.110	0.108	0.036	0.024	0.110	0.117	0.120	0.117	0.093	0.092	
Germany	0.075	0.078	0.074	0.071	0.060	0.056	0.136	0.132	0.032	0.028	0.075	0.079	
Sweden	0.056	0.054	0.048	0.046	0.084	0.064	0.048	0.044	0.042	0.044	0.059	0.056	
Austria	0.009	0.010	0.009	0.009	0.012	0.016	0.010	0.008	0.008	0.009	0.009	0.010	
Belgium	0.021	0.020	0.031	0.031	0.048	0.040	0.045	0.044	0.019	0.019	0.019	0.017	
Bulgaria	0.013	0.013	0.011	0.010	0	0	0.017	0.015	0.008	0.007	0.014	0.013	
Denmark	0.012	0.012	0.020	0.023	0.012	0.032	0.019	0.021	0.022	0.023	0.009	0.009	
Finland	0.036	0.038	0.027	0.028	0	0	0.029	0.031	0.029	0.031	0.038	0.041	
Hungary	0.021	0.018	0.006	0.005	0	0	0.002	0.002	0.010	0.009	0.024	0.021	
Ireland	0.031	0.031	0.036	0.035	0	0	0.043	0.046	0.036	0.032	0.030	0.030	
Italy	0.039	0.038	0.027	0.025	0	0	0.014	0.013	0.039	0.038	0.042	0.042	
Netherlands	0.028	0.027	0.035	0.036	0.060	0.080	0.036	0.036	0.030	0.028	0.026	0.024	
Poland	0.022	0.021	0.015	0.014	0.048	0.056	0.017	0.013	0.008	0.007	0.024	0.022	
Other 13	0.035	0.033	0.013	0.014	0	0	0.014	0.011	0.014	0.019	0.041	0.037	

### Appendix 3. Test of best-fitting model

The Akaike information criterion (AIC) and the log likelihood measures are used to check model-fitting. Table below reports estimated coefficients for AFT models with three exits, differentiated by density distribution function. The best-fitting model is the one with the largest log-likelihood and the preferred model is with the smallest AIC value. The AIC value criteria suggest loglogistic model, however generalized gamma model is favoured by the log likelihood measure. \*, \*\* and \*\*\* indicate that coefficient is significant at 10%, 5% and 1% respectively.

Parameter	Exponential			Weibull			Lognormal			Loglogistic			Generalized gamma		
	IPO	TS	LIQ	IPO	TS	LIQ	IPO	TS	LIQ	IPO	TS	LIQ	IPO	TS	LIQ
MANUFAC	-0.734	0.281	-0.312	-0.733	0.182	-0.241	-0.580	0.316*	-0.256	-0.667	0.222	-0.182	-0.607	0.209	-0.250
COMPUTER	0.343	0.106	-0.206	0.343	0.081	-0.152	0.451	0.059	-0.190	0.410	0.0374	-0.179	0.41	0.061	-0.190
BIOPHARMAC	-1.089*	0.222	0.019	-1.088*	0.178	0.044	-1.223**	0.101	0.029	-1.096**	0.114	0.013	-1.151*	0.144	0.020
COMMEDIA	0.181	-0.369*	-0.037	0.181	-0.323***	-0.079	0.128	-0.306**	-0.091	0.196	-0.331***	-0.112	0.159	-0.332***	-0.101
WHOLERETAILE	-0.768	-0.121	-0.275	-0.768	-0.107	-0.240	-0.554	-0.100	-0.287	-0.743	-0.145	-0.156	-0.619	-0.124	-0.259
FINANCE	-0.953	0.513	-0.197	-0.952	0.310	-0.161	-1.087	0.136	-0.098	-0.980	0.278	-0.093	-1.031	0.270	-0.109
AMOUNT (million euros)	-0.015***	-0.007***	0.055***	-0.015***	-0.004**	0.044***	-0.019***	-0.006***	0.0336***	-0.016***	-0.005***	0.047***	-0.018***	-0.005***	0.037***
NORTHERN	1.018	-0.356	-0.590**	1.018	-0.181	-0.445**	1.338**	-0.045	-0.421*	1.112*	-0.124	-0.293	1.244**	-0.148	-0.411*
SOUTHERN	2.101***	-0.220	-0.760***	2.100***	-0.109	-0.582***	2.457***	0.024	-0.531**	2.182***	0.000	-0.387*	2.337***	-0.058	-0.530*
WESTERN	0.809	-0.356	-0.604**	0.809	-0.168	-0.442**	1.031**	-0.061	-0.638***	0.905*	-0.115	-0.413**	0.987*	-0.139	-0.577***
SYNDSIZE (#investors)	-0.102*	-0.077**	0.020	-0.102*	-0.050**	0.013	-0.164**	-0.070***	0.042	-0.138**	-0.049**	0.041	-0.152*	-0.052**	0.040
AGEOLDESTVC (years)	-0.029**	-0.003	-0.002	-0.029**	-0.004	-0.003	-0.021*	-0.002	0.003	-0.027**	-0.004	-0.000	-0.024*	-0.003	0.002
SAMECOUNTRYVC	0.062	0.150	0.327**	0.062	0.117	0.284***	-0.020	0.186*	0.206*	0.013	0.119	0.196*	-0.003	0.128	0.223*
Fed tightening index	-0.040***	-0.051***	-0.054***	-0.040***	-0.038***	-0.047***	-0.051***	-0.052***	-0.079***	-0.040***	-0.046***	-0.075***	-0.046***	-0.042***	-0.072***
Euronext return	-0.145***	-0.136***	-0.149***	-0.145***	-0.085***	-0.120***	-0.184***	-0.103***	-0.188***	-0.169***	-0.103***	-0.179***	-0.177***	-0.094***	-0.176***
Log likelihood	-405.02649	-1414.9341	-1839.7538	-405.02647	-1344.7917	-1818.2026	-402.37996	-1358.5396	-1775.1791	-402.84871	-1336.6145	-1730.8972	-401.62481	-1341.4985	-1771.7783
AIC	842.053	2861.868	3711.508	844.0529	2723.583	3670.405	839.7599	2751.079	3584.358	839.6974	2707.229	3495.794	839.2496	2718.997	3579.557

## Appendix 4. Cox proportional hazard model

Cox proportional hazard model does not need to specify the baseline hazard. A positive regression coefficient for an explanatory variable means that the hazard is higher, and thus the exit time faster. Conversely, a negative regression coefficient implies a slower exit for VC firms. \*, \*\* and \*\*\* indicate that coefficient is significant at 10%, 5% and 1% respectively.

Variable	IPO	Trade sale	Liquidation
<i>Entrepreneurial firm-related variables</i>			
MANUFAC	2.072	0.747	1.370
COMPUTER	0.704	0.892	1.215
BIOPHARMAC	2.944**	0.758	0.945
COMMEDIA	0.816	1.680***	1.101
WHOLERETAIL	2.096	1.178	1.357
FINANCE	2.585	0.613	1.257
AMOUNT (million euros)	1.015***	1.007**	0.945***
NORTHERN	0.377	1.417	1.760**
SOUTHERN	0.129***	1.238	2.104***
WESTERN	0.458	1.387	1.752**
<i>VC-related variables</i>			
SYNDSIZE (#investors)	1.109*	1.087**	0.985
AGEOLDESTVC (years)	1.029**	1.006	1.004
SAMECOUNTRYVC	0.931	0.832	0.701***
<i>Market condition variables</i>			
Fed tightening index	1.041***	1.066***	1.061***
Euronext return	1.155***	1.149***	1.164***

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